

WJTA Jet News

Water Jet Technology
Association



AUGUST 1990

Published by the
Water Jet Technology
Association
for the benefit of its
members

818 Olive Street, Suite 918 • St. Louis, MO 63101, USA • Telephone: 314/241-1445, FAX: 314/241-1449

Abrasive Jet Cutting Increases Business Of A Job Shop By 40%

A large service center installed PASER II abrasive jets designed and manufactured by Flow International Corp. to cut metal alloys, composites, and laminates. By replacing conventional cutting methods with abrasive jet systems, the company increased productivity, reduced costs, and produced higher-quality parts.

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(right) Los Angeles-based HydroAbrasive Machining Inc. uses advanced PASER II™ abrasive jets made by Flow International to cut metal alloys, composites and laminates. The Flow abrasive jets are integrated into a two-station ASI Robotics Inc. gantry system that operates in a 120" x 300" x 36" work area. Photo courtesy of Flow International, Kent, Washington.



Water Jet Turf Aerator

The Toro Co. introduced a revolutionary new aerator which uses high velocity water to aerate putting surfaces. The "HydroJect™ 3000" penetrates deeper into the soil than conventional hollow time core aerators with less injury to the plant and root, without disturbing the playing surface.

Three years of research conducted at Michigan State University showed Toro's Water Injection Aerator reduced soil density and improved water infiltration at depths greater than those achieved by existing conventional aeration equipment. The HydroJect™ 3000 is capable of depths ranging from 4 to 8 inches with a single shot of

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HydroJect™ 3000 Aerator

Photo courtesy of The Toro Company, Bloomington, Minnesota.

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Accident Case Study - UK Job Shop

by Paddy Swan, S.P.D. Swan Consultants, Derbyshire, U.K.

Equipment

A 30-hp pump electrically driven at 5,000 psi and 8 gpm. A gun of the dump type and a fan jet to give surface coverage.

A jetting operator with one year of experience was asked to clean the walls of a large stainless steel vessel in a food processing plant. There was another member of the jetting team with a very limited experience in the area.

The operator had successfully completed the job and was changing position which involved leaving the vessel and climbing up some stairs. The other team member went up the stairs ahead of the operator carrying the gun, which still had low-pressure water flowing through one of its barrels. The operator carrying the gun slipped and a high-pressure jet penetrated his colleague's buttock.

On investigation, it was found that the barrels of the dump gun had been swapped round, i.e., the original dump now was the "live" barrel. This meant that the operator no longer had to hold the trigger when the gun was live. When the operator wanted to turn the gun "off," he pulled the trigger. When he moved position, he had the trigger held, and when he slipped, he released the trigger and, therefore, the jet.

WHAT DOES THIS MEAN?

(see answer on page 8)

Emergency Card

The following is the text of a card carried by some water jetters in England:

THIS MAN HAS BEEN INVOLVED WITH HIGH PRESSURE WATER JETTING AT PRESSURES UP TO 36,250 lb/in² (250 MPa, 2500 BAR, 2548 kg/cm²) WITH A JET VELOCITY OF 1536 MPH (680 MPS)

Please take this into account when making your diagnosis. Unusual infections with micro-aerophilic organisms occurring at lower temperatures have been reported. These may be gram negative pathogens such as are found in sewage. Bacterial swabs and blood cultures may therefore be helpful. Another particular hazard is Weil's Disease (leptospirosis). This may cause serious and even fatal illness which presents in the early stages as a flu-like illness with severe headaches, sometimes aseptic meningitis. Early treatment may prevent the onset of the more serious symptoms.

For advice contact:

Association Of High Pressure Water Jetting Contractors
28 Eccleston Street
London SW1W 9PY, England
Telephone (01) 730 7605

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Together Everyone Accomplishes More

Major R&D Program On Manufacturing Technology

Quest Integrated, Inc. (QI²) has been awarded a \$2.2 million contract by the National Center for Manufacturing Sciences (NOMS) to conduct a research program to develop the next generation of waterjet and abrasive-waterjet (ADJ) processing technologies. QI² is a small contract R&D firm that has been operating in the Kent, WA, area as Flow Research since 1970.

NOMS is a consortium of manufacturing companies committed to advancing the state of manufacturing processes and technologies within the U.S. and improving the level of U.S. manufacturing competitiveness. This research program is the first phase of a much larger planned effort to develop new manufacturing processes and technologies and to transfer or implement these advances in U.S. companies.

QI² has remained at the forefront of high-pressure waterjet technology since its inception and has continued to conduct programs to further develop and advance the technology. One such advance was the introduction 10 years ago of abrasives into the waterjet.

Mr. William Coleman, Vice President at QI², will serve as the program manager for the NCMS study, and Dr. Mohamed Hashish, Senior Scientist at QI², will be the Principal Investigator. Dr. Hashish is a pioneer in the development of the AWJ technology and an internationally recognized expert in the field.

Several leading firms and academic organizations actively engaged in advanced manufacturing developments and applications may become involved as subcontractors to QI². Included are General Electric/Aircraft Engines Division, Flow International Corporation, and the University of Texas at Arlington. GE Aircraft Engines has a strong interest in the AWJ cutting process for application in the machining of advanced superalloys and composites and has worked with QI² on several development studies.

Flow International Corp., a leading supplier of waterjet cutting systems worldwide, will provide equipment and expertise in high-pressure pumping technology. The University of Texas, Arlington, through the Automation and Robotics Research Institute, will provide expertise in robot and manipulator systems. Experts from other academic institutions, including the Universities of Rhode Island and Wisconsin/Milwaukee, will be involved as consultants in the development of a thorough, comprehensive program that will lead U.S. industry to the forefront in advanced manufacturing technologies.

In addition to engineering developments in waterjet and high-pressure technology, QI² also has a group of recognized scientists in applied physics conducting research on sonic and supersonic flows, turbulence, and oceanography.

For more information, contact William Coleman, Quest Integrated, Inc., (206) 872-9500.

Conference Proceedings Available

The official Proceedings of the 5th American Water Jet Conference, held August 27-31, 1989, in Toronto, Ontario, Canada, are available in a single, hard cover volume. A variety of presentations relating to the following general topics are included: Rock Cutting; Basic Studies; Concrete, Construction and Industrial Uses; Coal and Soil Cutting; Medical Applications and Safety Considerations.

The Proceedings are available for \$75.00 each, plus \$5.00 for shipping and handling (in continental U.S.). Additional shipping charges apply for destinations outside the U.S. To order, contact:

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From The President's Desk...

A copy of the 1990-1991 Membership Directory will be mailed to all members in late August. The directory includes the addresses, telephone numbers, and a description of services offered by 272 individual and 53 corporate members. These numbers represent an increase of 20 corporate and 94 individual members over 1989. We have members in 37 states of the United States and in 14 countries.

This issue of *Jet News* is focused on productivity. "Water Jet Turf Aerator" shows how a new water-jet cutting aerator can aerate golf course putting surfaces so quickly and unobtrusively that play is not disrupted.

"Abrasive Jet Increases Business in a Job Shop by 40%" shows how a Los Angeles firm increased productivity, reduced costs, expanded business, and produced higher quality parts by introducing abrasive jet cutting with robotics.

"Major R&D Program on Manufacturing Technology" announces a new contract by the National Center for Manufacturing Sciences to develop new waterjet and abrasive jet manufacturing technologies.

This issue also spotlights safety. An example of an emergency card is included along with a case history of an accident caused by tampering with a safety device.

- George A. Savanick, Ph.D.

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Abrasive Jet Cutting Increases Business Of A Job Shop By 40%, from page 1



PASER II™ abrasivejet cutting systems manufactured by Flow International produce high-quality parts from tough-to-cut materials such as metal alloys, composites and laminates. Unlike other cutting processes, abrasivejets create no heat-affected zones and do no damage to even the most fragile parent materials. The process leaves a smooth, finished edge which minimizes or eliminates the need for additional machining operations. Photo courtesy of Flow International, Kent, Washington.

HydroAbrasive Machining, Inc. is a major independent service center supporting defense, aerospace, and manufacturing companies throughout the nation. Headquartered in Los Angeles, the firm's parent company was founded in 1947 by Morris Woolman.

In the late 1970's, the company installed cutting shears and a hand-held plasma-arc cutting torch and began providing customers with metal cutting services. In the early 1980's, it upgraded operations by installing three CNC plasma-arc cutting systems.

Initially, HydroAbrasive Machining was very successful with these systems because it was one of the few job shops in Southern California with plasma-arc cutting capabilities. But by 1985 the firm faced increasing competition and plasma-arc systems couldn't cut many of the new alloys — such as titanium and Inconel™ without causing heat-affected zones or hardened edges that must be removed. In addition, some of the modern composite materials, such as Kelvar™, couldn't be cut at all using plasma-arc cutting methods.

Managers considered laser cutting systems, but found that laser systems had some of the same disadvantages as plasma-arc cutting — namely, the creation of heat-affected zones and the need for secondary finishing.

HydroAbrasive Machining needed a clean, fast, precise cutting system to expand its business, maintain a competitive edge, and provide high-quality results at an economical cost.

(continued on page 6)

The Cutting Edge by George A. Savanick

Flow Research, Inc. changed its name to **Quest Integrated, Inc.** effective March 1990. Their address remains:

2144 68th Ave. S.
Kent, Washington 98032
Phone: (206) 872-9500
Fax: (206) 872-8967

Cutting thick, multiphased fabrics continues to be an application with problems. The jet either frays the fabric strands or simply pushes the strands aside. Work continues, however.

The June 30, 1990, issue of the *Savannah News Press* reported that a 2-ton sample of phosphate ore was collected from the Continental Shelf offshore Tybee Island, Georgia, using a borehole miner. A borehole miner uses waterjet to slurriify the ore beneath the sea floor. This work is funded by the U.S. Minerals Management Services.

Water Jet Turf Aerator, from page 1

water, and should help break through any "hardpan" which is a compacted layer in the soil caused by regular cultivation at the same depth over a period of years. For areas with drainage issues, the HydroJet is capable of depths beyond 20 inches using multiple shots.

The Michigan State study also found that after several HydroJet™ 3000 treatments, the soil revealed roots growing the full length of the channels, with lateral roots growing into the adjacent soil. This root contact with the soil deeper in the profile should improve water uptake and related stress tolerance of the turf.

"Golf course superintendents and turf managers will benefit greatly from Water Injection Aeration," said Ben Street, Associate Commercial Marketing Manager. "Toro's HydroJet™ 3000 aerator does not disturb the playing surface or damage turf, thus aeration can be accomplished at any time without disrupting play which can upset golfers. Superintendents can treat greens and other turf areas when relief is needed most," said Street.

The HydroJet™ 3000 provides all the benefits of core aeration except for conditions requiring core removal for significant thatch reduction or gradual restructuring of underlying soil composition.

Upcoming Events

September 19, 1990

Industrial Applications of Water Jet Technology, Ramada Inn Westport, St. Louis, MO, 9:00 a.m. - 3:00 p.m., \$150 per person. Please contact Ralph Wehrmann, (314) 889-2911, University of Missouri, Business Extension Center, St. Louis, MO.

October 11-12, 1990

Waterjet Short Course - Milwaukee, Wisconsin. Please contact Roger Hirons, University of Wisconsin Extension, (414) 227-3105.

October 30 - November 2, 1990

Tenth International Symposium on Jet Cutting Technology, Amsterdam, Holland. Further details can be obtained from the Symposium Organizer, BHRA, The Fluid Engineering Center, Cranfield, Bedford, MK43 0AJ; England, telephone (0234) 750422; telex 825059; fax (0234) 750074.

May 7-8, 1991

First Asian Conference on Recent Advances in Jetting Technology, Singapore. Please contact Cl-Premier PTe Ltd., 150 Orchard Road, #07-14, Orchard Plaza, Singapore - Tel: 733 2922; Fax: 235-3530.

August 24-27, 1991

Sixth American Water Jet Technology Conference, Houston, Texas. Please contact the Water Jet Technology Association, (314) 241-1445.

September 24-26, 1991

Geomechanics '91, Hrodac, Czechoslovakia. Please contact Z. Rakowski, Mining Institute of Czechoslovak Academy of Science, A. Rimana 176B, 70800 Ostrava Poruba, Czechoslovakia.

Abrasive Jet Cutting Increases Business Of A Job Shop By 40%, from page 5

The Solution

The company chose to install Flow International's PASER abrasive jet cutting system which can cut titanium, Inconel, Kelvar, and other alloys, composites, and laminates quickly and cleanly, leaving behind a quality edge that usually requires no further finishing. HydroAbrasive Machining credits 40 percent volume increase in only 4 years directly to the decision to install abrasive jets. Today, 65 percent of the company's work involves the use of PASER abrasive jets.

"The abrasive jet cutting system was selected because of its ability to cut all types of materials, including composites," said Richard Woolman, president and general manager. "Abrasive jets can also be used to process thicker materials to required tolerances. Also, the systems had a lower initial cost than most other traditional cutting methods."

Flow's unique intensifier pumps pressurize water up to 55,000 psi and force it through a precision orifice at up to three times the speed of sound. Abrasives such as garnet are entrained in the water stream to create the abrasive action necessary to slice cleanly through hard materials.

In 1986, HydroAbrasive Machining installed its first abrasive jet cutting system, integrating the abrasive jets with a CNC unit. In a work area of 72 by 180 inches, the system provides a two-axis operation at each of two cutting stations.

Introducing PASER II

Two years later, the company installed a second Flow abrasive jet cutting system as part of ASI Robotics Systems gantry robot with a work area of 120 by 264 by 36 inches. This system has both five-axis and three-axis cutting stations. The two cutting stations in each system can handle heavy-duty dual cutting applications and provide backup for each other.

The latest edition, installed in 1989, is a two-station ASI system with a work area of 120 by 300 by 36 inches. It is fitted with advanced PASER II abrasive jets which feature improvements in the abrasive feed system and in the cutting head. These enhancements were designed to increase uninterrupted cutting and to lower operating costs.

A computer with an interactive graphics program and a nesting system for plotting two-dimensional parts precisely defines a variety of complex configurations. A five-axis software system directs the machining of contoured airfoils and other difficult shapes.

Richard Woolman pointed out, "Abrasive jet cutting is very versatile. It can be used to achieve net or near-net machining of many different materials, including metals such as rotor grade 6-4 titanium."

"This is because, unlike techniques that use arcs or flames, the process produces virtually no heat on cut surfaces," he explained. "As a result, there is no heat-affected zone and no damage to even the most fragile parent materials. The process leaves a smooth, finished edge, which minimizes or eliminates the need for additional machining operations." According to Woolman, abrasive jet cutting is a cleaner, safer process than conventional cutting methods. Contaminating dust is carried away with the water stream to a catcher.

To produce jet engine rotary blade repair patches made of 6-4 titanium, workers used to rough cut the parts with the plasma-arc systems and then the customer had to grind and machine them to the required dimensions. With a 0.200-inch cut, plus the excess material left behind to be machined away later, the plasma-arc system was expensive in terms of material costs.

PASER II abrasive jets have eliminated the need for grinding, and the machining operations are confined to the radius side of the part. In addition, the abrasive jet cut is from 5 to 20 times narrower, which results in significant material savings.

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Abrasive Jet Cutting Increases Business Of A Job Shop By 40%, from page 6

Cutting titanium composite laminates at 1-inch/hour with other conventional methods such as diamond wheels was a slow process. The parts usually needed additional finishing and the wheels required frequent replacement or resharping to prevent the delamination and edge-fraying caused by a worn cutting tool. PASER II abrasive jets cut titanium composite laminates at a rate of 1-inch/minute - a cutting speed 60 times faster than diamond wheels.

In another case, aerospace piping supports made of saw cut 0.250-inch-thick Inconel 718 blanks used to be cut using electrical discharge machining at a rate of one part per hour. Now, Flow's abrasive jet cutting system produces a support to required tolerances without heat-affected zones every 20 minutes, including finished profile machining time. The result - productivity increases more than 3 times and costs are reduced by 75 to 80 percent. PASER II eliminates the saw operation and saves the company 25 percent on materials.

HydroAbrasive Machining uses PASER II to cut many metal matrix composites such as Kevlar and graphite epoxy. The company's experience shows that these composite materials, including the polyetheretherketone (PEEK) used in radar domes, can be cut with burr-free edges and surface finishes ranging from RMS 32 to 125.

In addition, they can cut a wide variety of signs, logos, architectural shapes, and other types of intricate artistic work from stainless steel, brass, marble, plastic, and other materials. Previously, jobs like these required expensive hand-routing.

"We're very pleased with our progress so far," summed up Richard Woolman. "We anticipate that the market for this new cutting process will continue to expand rapidly in the future."

Call For Papers

6th American Water Jet Technology Conference

Oral and Poster Sessions will be featured at the 6th American Water Jet Technology Conference. Authors wishing to present papers are invited to submit abstracts for consideration. An Abstract Review Committee consisting of six referees, chosen from the Organizing Committee and the body of International Advisors, will review the abstracts and decide their suitability for inclusion in the Conference.

To submit an abstract(s), please complete the enclosed Abstract Submission Form and forward to the attention of the Conference Coordinator at the Water Jet Technology Association. Abstracts are to be submitted NO LATER THAN DECEMBER 1, 1990, to ensure consideration. Authors will be advised by January 15, 1991, regarding the decision of the abstract Review Committee.

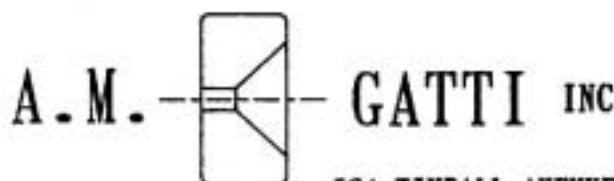
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Accident Case Study – UK Job Shop, from page 2

WHAT DOES THIS MEAN?

1. The gun can be regarded as a piece of "safety equipment" as defined under U.K. law. The operator had clearly interfered with this producing a "fail to danger" situation.
2. The operator could be liable, in not only civil proceedings, but also a criminal prosecution under U.K. law.

MORAL: Making a job easier does not always make it safer.

An interesting departure from wedging, blocking, or trying the trigger. Most manufacturers now recognize that excessive trigger pressure is an important component in encouraging such behavior.

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Mark Your Calendars!

WJTA

Water Jet Technology
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6th American
Water Jet
Technology
Conference

August 24-27, 1991
Westin Galleria
Houston, Texas

The Preliminary Conference Program Includes:

- Scientific Papers
- Short Course On Water Jet Technology
- Jet Application Symposia
- Field Demonstration And Technical Tour
- Technical Exhibits
- Spouse Program
- Awards Banquet
- Texas Hospitality

For additional information regarding the 6th American Water Jet Technology Conference, contact the:

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